

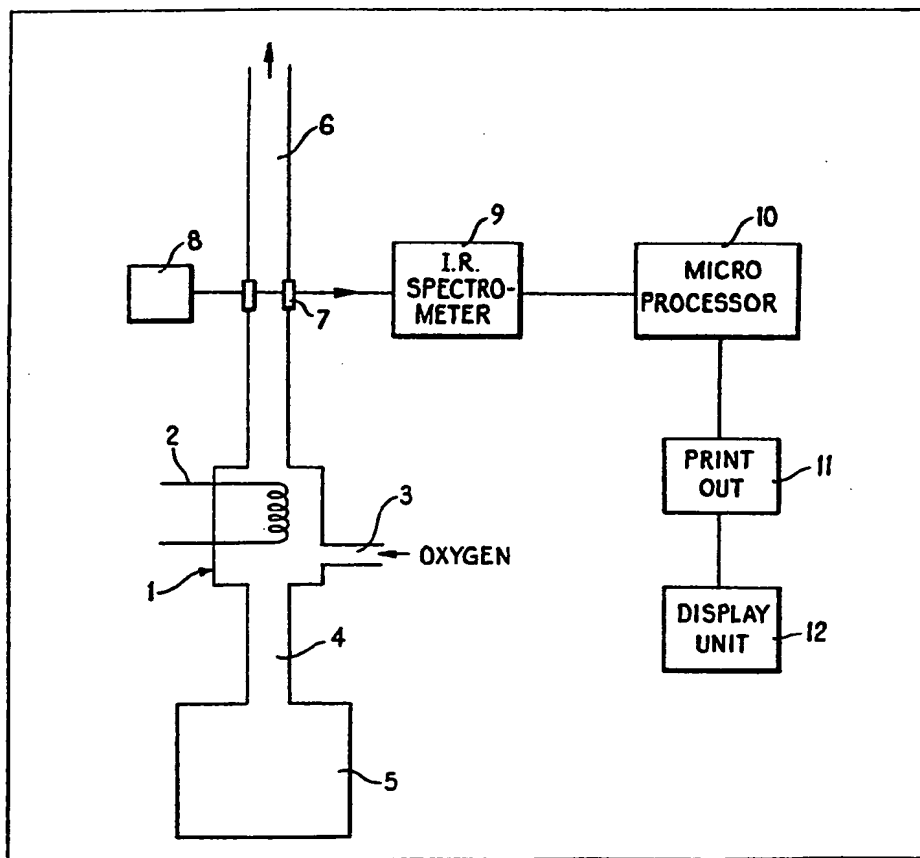
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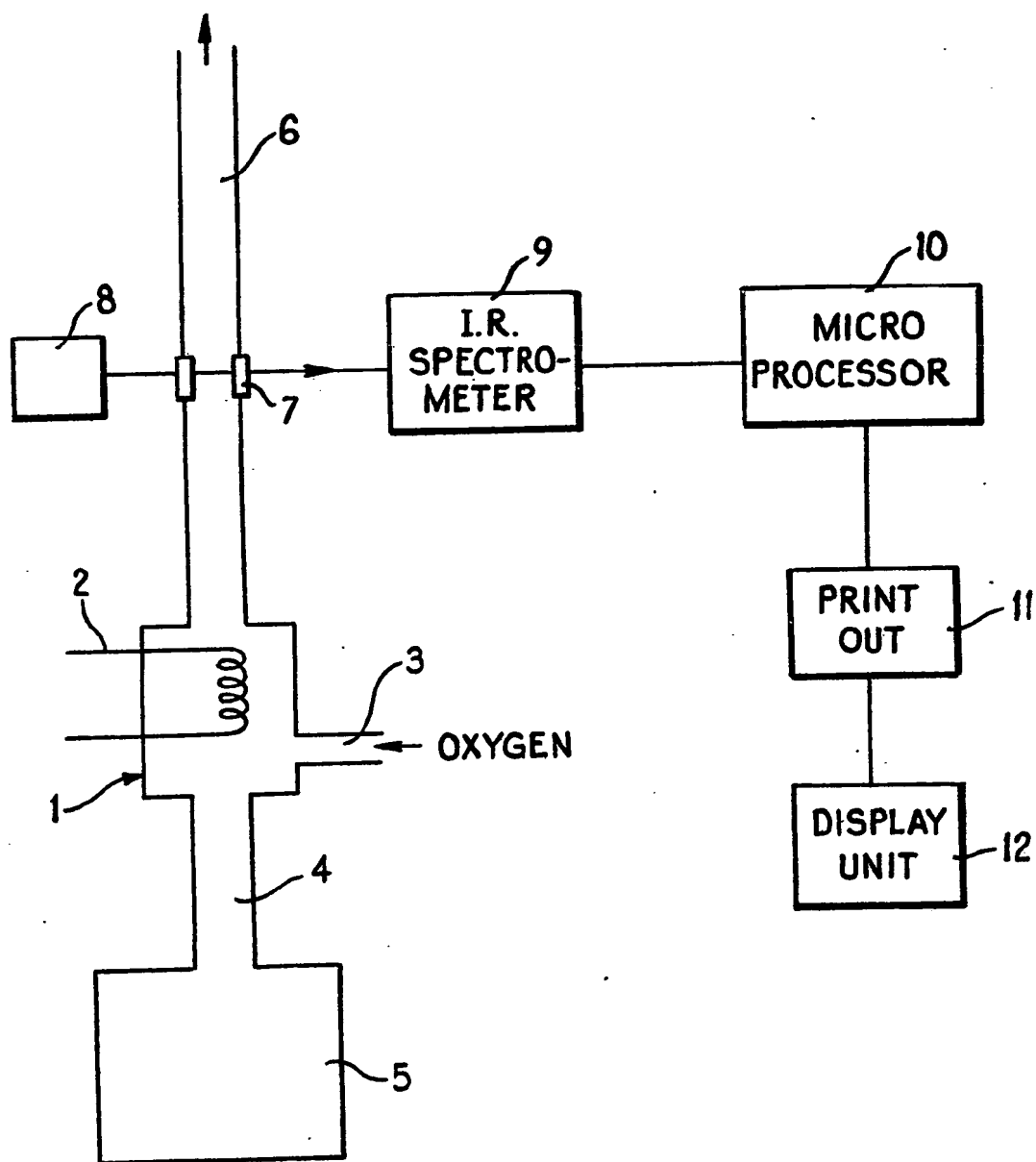
(54) Determining oil consumption of an I.C. engine

(57) A method of measuring the consumption of lubricating oil by an internal combustion engine comprising the operations of isotopically labelling representative fractions of oil with deuterium atoms, circulating the lubricating oil through an engine under test, and measuring

the amount of deuterium emitted from the exhaust pipe of the engine. Apparatus comprising means for subjecting the exhaust gas to an oxidizing environment and an infra-red transmissive region in which the infra-red spectrum of the gas can be observed for the determination of HDO from the O—D band stretch is also described. Preferably at least 10% of the hydrocarbons in the oil are deuterated.



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## SPECIFICATION

**Improvements in or relating to the measurement of the consumption of oil by internal combustion engines**

5 The present invention relates to the measurement of the consumption of lubricating oil by internal combustion engines.

In these days of increasing concern about the possible running out of oil supplies and the pollution of the environment by oil discharged from internal combustion engines, there is a growing need for equipment to enable engine designers and manufacturers to determine how much of the oil used by an engine is discharged from the exhaust pipe of the engine either as combustion products or as unburnt droplets.

10 According to the present invention there is provided a method of measuring the consumption of lubricating oil by an internal combustion engine comprising the operations of isotopically labelling representative fractions of oil with deuterium atoms, circulating the lubricating oil through an engine under test, and measuring the amount of deuterium emitted from the exhaust pipe of the engine.

15 Preferably the method includes the operations of passing the exhaust gases through an after-burner to ensure that all the deuterium present in the exhaust gases is in the fully-oxidised state, and then measuring the quantity of the molecule HDO which is present, by infra-red spectroscopy.

20 Also according to the invention there is provided an apparatus for carrying out the method comprising means for ensuring that deuterium-containing exhaust emissions from an internal combustion engine under test are subjected to an oxidising environment, an outlet from the oxidising means which includes a region which is transparent to infra-red radiation, an infra-red spectrometer arranged to observe exhaust gases passing along the outlet, and means connected to the infra-red spectrometer and adapted to produce an output signal indicative of the amount of deuterium present in the exhaust gases from the engine under test.

25 The invention will now be described, by way of example, with reference to the accompanying diagrammatic representation of an arrangement for carrying out the invention.

30 Referring to the drawing, an arrangement for measuring the oil loss from an internal combustion engine consists of a gas oxidiser 1 containing an electrically heated coil 2 and an oxygen inlet 3, which is connected to an exhaust pipe 4 which is attached to an internal combustion engine 5 under test. The oxidiser 1 has an outlet pipe 6 which includes a region 7 which is transparent to infra-red radiation. An infra-red source 8 and spectrometer 9 are arranged so that gases proceeding along the outlet pipe 5 can be analysed. A microprocessor 10 is arranged to control the spectrometer 9 and derive from the magnitude of the infra-red absorption band arising from the stretching frequency of the O—D bond in

65 the HDO molecule an output signal indicative of the amount of deuterium present in the exhaust gases from the engine 4. This signal is recorded on a print-out device 11 and indicated on a visual display unit 12.

70 The O—D stretching frequency band is chosen for the measurement of the deuterium content of the exhaust gases from the engine 4 because it is so well removed from that of the O—H bond, that interference from water is minimal. Furthermore, at the concentration levels at which deuterium is present in the exhaust gases, the concentration of D<sub>2</sub>O is insignificant.

75 In order to obtain reasonable sensitivity and accuracy it is desirable that some ten per cent of the hydrocarbons in the oil should be deuterated. One way in which this can be done is by an exchange reaction using D<sub>2</sub>SO<sub>4</sub>. Alternatively, representative fractions of the oil, preferably those having between twenty and thirty carbon atoms per molecule, can be deuterated completely and then added to an oil until they are present at a concentration of about ten per cent.

80 The technique has the advantages that it is a tracer method which does not make use of radioactive substances, that the tracer is truly representative of oil behaviour, and that the response time is small, of the order of seconds.

## CLAIMS

1. A method of measuring the consumption of lubricating oil by an internal combustion engine comprising the operations of isotopically labelling representative fractions of oil with deuterium atoms, circulating the lubricating oil through an engine under test, and measuring the amount of deuterium emitted from the exhaust pipe of the engine.

2. A method according to Claim 1 wherein there is included the operations of passing the exhaust gases through an after-burner to ensure that all the deuterium present in the exhaust gases is in the fully-oxidised state and measuring the quantity of the molecule HDO present in the exhaust gases.

3. A method according to Claim 2 wherein the quantity of HDO present in the exhaust gases is measured by infra-red spectroscopy.

4. A method according to any of Claims 1—3 wherein at least ten percent of the hydrocarbons in the oil are deuterated.

5. An apparatus for carrying out the method comprising means for ensuring that deuterium-containing exhaust emissions from an internal combustion engine under test are subjected to an oxidising environment, an outlet from the oxidising means which includes a region which is transparent to infra-red radiation, an infra-red spectrometer arranged to observe exhaust gases passing along the outlet, and means connected to the infra-red spectrometer and adapted to produce an output signal indicative of the amount of deuterium present in the exhaust gases from the engine under test.

6. A method of measuring the consumption of lubricating oil by an internal combustion engine substantially as hereinbefore described with reference to the accompanying drawing.

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7. An apparatus for measuring the consumption of lubricating oil by an internal combustion engine substantially as hereinbefore described with reference to the accompanying drawing.

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